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## **MORTALITY FROM CERTAIN CAUSES DURING THE FIRST HALF OF 1935 <sup>1</sup>**

This report covers mortality in 31 States and Hawaii for the first half of 1935, with comparative data for the first half of the 3 preceding years. In addition to the death rate from all causes, rates are shown for 4 groups of diseases and 18 specific causes, some of which are included in the groups. Infant and maternal mortality rates per 1,000 live births are also shown.

The rates are computed from current and generally preliminary reports furnished by State departments of health. Because of some lack of uniformity in the method of classifying deaths according to cause, some delayed death certificates, and various other reasons, these preliminary rates cannot be expected to agree in all instances with final rates published by the Bureau of the Census. The final figures are based on a complete review and retabulation of the individual death certificates from each State. The preliminary rates given in the accompanying table are intended to serve as a current index of mortality until final figures are available.

In a group of 26 States <sup>2</sup> with an estimated population of about 90,000,000 the death rate for the first half year was the same in 1935 as in 1934, 11.5 per 1,000 (annual basis). The rates in 1933 and 1932 were less, 11.1 and 11.3, respectively. In approximately the same group of States the rate in the first half of 1931 was 11.8. In the first quarter the rate for 1935 was identical with that for 1934, and in the second quarter it was practically the same, 11.0 in 1935 and 11.1 in 1934. In both quarters the rates were less in 1933 and 1932 than in 1935 and 1934.

Infant mortality was 58 per 1,000 live births in the first half of 1935, as compared with 61, 59, and 59 in 1934, 1933, and 1932, respectively. Of 27 States with complete data for both years, in 5 the rate increased in 1935 over 1934, in 2 it remained the same, and in 20 it decreased.

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<sup>1</sup> From the Office of Statistical Investigations, U. S. Public Health Service.

<sup>2</sup> See footnote to table for States included.

Tuberculosis mortality declined from 57.6 per 100,000 in the first half of 1934 to 56.3 in the first half of 1935. The decline in 1935 from the 1934 rate was less than in preceding years. Of 29 States with complete data, in 19 the rate decreased in 1935 and in 10 it increased. There was a very minor epidemic of influenza in the first half of 1935. The death rate from influenza, 30.1 per 100,000, is higher than in 1934 (22.0), which year was relatively free from this disease, but less than in 1933 (37.3) and 1932 (34.7), when minor epidemics occurred. In every State the influenza death rate in the first half of 1935 was higher than in the same half of 1934.

The pneumonia death rate in 1935 was the highest in the 4 years included, but was only slightly above that for 1934, when little influenza was present. In 9 States the rate was higher in 1935 than in 1934, and in 20 States it was lower. In both 1935 and 1934 the measles and whooping cough death rates were higher than usual, and the high pneumonia rates may be due in part to complications of these diseases in which the death certificate did not carry the preceding cause.

Measles and whooping cough death rates were both slightly less than in 1934. For measles, 14 of the 29 States had lower rates in 1935 than in 1934 and 15 had higher. For whooping cough, 20 of the 29 States had lower rates in 1935 than in 1934 and 9 had higher.

The typhoid fever death rate for the first half of 1935 was 1.0 per 100,000, as compared with 1.3, 1.4, and 1.8 for the first half of 1934, 1933, and 1932, respectively. Nineteen of the twenty-nine States had lower rates in 1935 than in 1934. The crude rate for diarrhea and enteritis under 2 years per 1,000 total population was also less than in preceding years. The declining birth rate, with the resulting smaller proportion of the population under 2 years of age, would produce a decline in this crude rate. Using as a population base the births in the current half year and the corresponding half of the preceding year, the rates per 1,000 live births in the group of States were 2.0, 2.4, and 2.2 for the first half years of 1935, 1934, and 1933, respectively.

The death rates from heart diseases, cerebral hemorrhage, and cancer increased in 1935 over 1934. The rate from nephritis was less than last year, and the rate from diabetes was practically the same. The majority of these degenerative diseases have for many years been either increasing or maintaining approximately the same level.

[Estimated population July 1, 1935, 90,257,000]

JANUARY TO JUNE

<sup>a</sup> Data not available.

Mortality from certain causes in the first 6 months of 1935, with comparative data for the corresponding period in preceding years—Continued

State and period	Rate per 1,000 live births			Death rate per 100,000 populat on (annual basis)																			All causes, rate per 1,000 popu- lation (annual basis)			
	Total infant mortality	All except malforma- tions and early infancy	Maternal mortality	Typhoid fever (1, 2)	Measles (7)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Influenza (11)	Polymyellitis (16)	Lethargic encephalitis (17)	Meningococcus menin- gitis (18)	Tuberculosis, all forms (23-32)	Cancer, all forms (45-53)	Diabetes (59)	Diseases of the nerv- ous system (78-89)	Cerebral hemorrhage, apoplexy (82a, b)	Diseases of the circula- tory system (90-103)	Diseases of the heart (90-95)	Diseases of the respi- ratory system (104-114)	Pneumonia, all forms (107-109)	Diseases of the diges- tive system (115-129)		Diarrhea and enteritis, under 2 years (119)	Nephritis (130-132)	
JANUARY TO JUNE—CON.																										
California:																										
1935.....	51	21	4.7	.9	1.6	1.2	.9	1.7	11.7	.4	.4	2.1	76.3	131.4	25.2	108.0	82.1	302.4	319.8	79.5	67.5	73.9	5.2	82.4		
1934.....	54	24	4.7	1.1	2.3	1.5	3.9	1.7	7.1	1.5	.4	.9	79.2	128.2	22.1	103.3	77.3	324.9	290.4	76.0	64.3	68.0	8.2	79.9		
1933.....	55	24	5.1	.9	2.5	1.4	3.3	2.1	21.9	.1	.5	1.6	81.3	127.4	24.0	117.8	87.0	320.7	286.2	89.3	76.4	64.3	4.8	83.7		
1932.....	54	24	6.2	1.1	1.6	1.0	2.3	3.4	13.0	.8	.5	1.7	87.1	119.5	21.3	107.6	79.8	294.8	260.5	82.2	69.1	64.8	6.7	86.2		
Connecticut:																										
1935.....	47	( <sup>c</sup> )	5.6	.7	3.4	2.0	1.3	.9	12.3	.2	.5	1.1	47.2	123.8	34.6	( <sup>c</sup> )	( <sup>c</sup> )	( <sup>c</sup> )	212.7	242.7	( <sup>c</sup> )	90.0	( <sup>c</sup> )	1.5	92.7	
1934.....	55	( <sup>c</sup> )	5.6	.5	2.0	1.0	1.2	.4	10.1	( <sup>c</sup> )	.9	.7	46.8	122.0	28.6	( <sup>c</sup> )	( <sup>c</sup> )	( <sup>c</sup> )	240.4	240.4	( <sup>c</sup> )	88.7	( <sup>c</sup> )	3.9	94.9	
1933.....	55	( <sup>c</sup> )	7.5	.5	1.0	2.0	2.3	1.2	35.7	( <sup>c</sup> )	.9	.5	54.0	130.6	25.3	( <sup>c</sup> )	( <sup>c</sup> )	( <sup>c</sup> )	216.0	216.0	( <sup>c</sup> )	93.1	( <sup>c</sup> )	4.5	92.0	
1932.....	58	( <sup>c</sup> )	6.1	.7	1.8	1.7	3.9	1.0	22.5	.4	1.0	1.0	54.4	114.1	29.1	( <sup>c</sup> )	( <sup>c</sup> )	( <sup>c</sup> )	226.4	226.4	( <sup>c</sup> )	89.3	( <sup>c</sup> )	3.9	94.6	
District of Columbia:																										
1935.....	62	29	4.9	1.6	( <sup>c</sup> )	3.2	.4	4.5	21.4	( <sup>c</sup> )	1.6	2.8	135.4	153.6	34.0	153.2	120.4	483.7	427.6	224.7	204.1	108.3	10.9	126.9		
1934.....	68	38	3.1	.4	19.4	2.0	11.7	1.2	10.9	.4	1.2	2.9	130.6	148.2	37.7	150.2	113.4	428.1	428.1	185.1	163.2	98.4	10.1	124.0		
1933.....	64	26	5.0	1.2	1.2	4.9	.4	1.6	15.5	( <sup>c</sup> )	1.4	2.9	135.3	153.2	27.7	187.0	127.1	428.6	353.6	149.9	131.6	107.1	9.4	129.6		
1932.....	69	31	8.5	.8	( <sup>c</sup> )	4.4	5.7	4.8	17.8	.4	2.0	4.8	128.4	156.5	29.9	165.6	117.5	402.2	344.1	184.5	162.3	86.8	4.8	138.7		
Florida:																										
1935.....	69	40	9.1	2.3	3.4	( <sup>c</sup> )	3.9	3.9	59.2	.6	( <sup>c</sup> )	.6	57.2	86.0	22.5	124.2	98.4	250.9	230.1	96.5	81.4	94.1	16.2	111.1		
1934.....	72	70	37	8.0	3.1	9.6	.4	5.6	36.3	.5	.5	.1	62.1	81.6	17.1	130.8	96.0	255.8	236.3	104.5	90.6	94.1	14.3	124.9		
1933.....	70	35	11.4	4.6	1.1	.9	3.8	3.8	61.5	.5	.8	.8	66.1	82.1	15.9	121.3	92.6	208.8	191.4	76.9	66.2	73.6	8.2	122.3		
1932.....	65	34	9.8	6.2	1.0	.6	1.8	5.2	35.8	.6	( <sup>c</sup> )	( <sup>c</sup> )	73.6	76.3	17.0	122.0	104.7	204.2	188.9	75.1	62.6	92.3	14.3	108.4		
Georgia:																										
1935.....	75	( <sup>c</sup> )	8.0	3.7	1.5	.7	7.0	3.0	69.7	.7	.1	1.0	58.4	53.0	12.4	108.7	75.2	174.4	163.4	128.9	118.8	77.4	16.5	107.1		
1934.....	93	( <sup>c</sup> )	8.2	5.6	32.5	.5	12.0	4.2	44.2	.6	.3	.7	60.0	53.9	12.9	113.4	74.4	180.7	165.9	139.5	128.5	74.2	17.2	104.5		
1933.....	93	( <sup>c</sup> )	8.7	4.4	1.7	.4	6.4	2.7	66.2	.9	.1	1.0	57.8	51.3	11.6	101.1	71.0	180.7	121.3	94.2	86.1	61.5	12.5	106.0		
1932.....	70	( <sup>c</sup> )	9.7	8.6	.5	1.2	4.0	4.0	45.4	1.2	.6	1.0	67.7	48.8	11.9	118.4	81.6	143.7	132.2	110.4	101.1	62.6	10.6	111.9		
Hawaii:																										
1935.....	68	42	5.4	2.4	( <sup>c</sup> )	( <sup>c</sup> )	3.3	( <sup>c</sup> )	7.6	( <sup>c</sup> )	( <sup>c</sup> )	1.4	75.3	63.4	15.2	61.1	46.4	119.8	111.2	82.8	72.0	68.6	24.1	70.5		
1934.....	89	60	6.6	3.9	.5	( <sup>c</sup> )	16.6	1.0	20.9	.6	( <sup>c</sup> )	1.5	83.1	62.2	18.0	56.4	36.9	112.2	107.3	176.9	160.0	80.3	35.0	80.3		
1933.....	79	50	5.3	8.0	.5	( <sup>c</sup> )	16.6	2.0	9.5	1.0	( <sup>c</sup> )	1.0	104.8	70.9	14.0	68.4	48.9	118.3	107.3	107.3	91.8	102.3	44.9	77.9		
1932.....	82	( <sup>c</sup> )	( <sup>c</sup> )	2.0	12.8	.6	2.0	7.2	6.1	1.0	.6	4.6	96.7	67.0	8.7	( <sup>c</sup> )	50.1	( <sup>c</sup> )	98.2	( <sup>c</sup> )	115.6	116.2	57.8	64.5		

Idaho:	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	293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**No deaths.**

**Data not available.**

**5 months only.**

Mortality from certain causes in the first 6 months of 1935, with comparative data for the corresponding period in preceding years—Continued

State and period	Rate per 1,000 live births					Death rate per 100,000 population (annual basis)																					
	All causes, rate per 1,000 popu- lation (annual basis)	Total infant mortality	All except malforma- tions and early infancy	Maternal mortality	Typhoid fever (1, 2)	Measles (7)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Influenza (11)	Polio-myelitis (16)	Lethargic encephalitis (17)	Meningococcus menin- gitis (18)	Tuberculosis, all forms (23-32)	Cancer, all forms (45-53)	Diabetes (59)	Diseases of the nerv- ous system (78-89)	Cerebral hemorrhage, apoplexy (82a, b)	Diseases of the circula- tory system (90-103)	Diseases of the heart (90-95)	Diseases of the respir- atory system (104-114)	Pneumonia, all forms (107-109)	Diseases of the diges- tive system (115-129)	Diarrhea and enteritis, under 2 years (119)	Nephritis (130-132)		
JANUARY TO JUNE—CON.																											
Montana:																											
1935.....	12.1	63	(1)	5.2	1.9	17.3	3.0	6.0	3.4	69.3	4	1.1	3.0	45.4	100.6	18.4	109.3	83.7	225.7	298.8	170.1	153.1	104.4	6.4	79.2		
1934.....	10.3	49	(1)	6.5	1.5	2.6	3.4	2.4	1.9	37.9	(1)	1.1	1.6	49.2	89.0	20.3	101.4	76.6	194.1	177.2	107.8	92.4	80.7	6.4	72.5		
1933.....	9.7	59	(1)	5.2	2.0	4.4	2.6	2.4	2.2	60.6	1.5	1.6	1.4	54.4	79.7	12.1	99.9	76.8	169.8	168.7	83.8	71.3	69.1	4.8	62.1		
1932.....	9.9	49	(1)	5.3	2.2	3.0	2.4	3.0	2.7	60.6	1.5	1.1	1.9	56.7	86.3	19.1	106.5	73.6	183.5	165.2	85.6	69.5	68.4	3.4	68.8		
Nebraska:																											
1935.....	10.1	48	24	5.8	6	11.3	3.5	1.2	1.4	35.1	3	0	4.2	22.2	100.0	20.1	132.0	103.3	211.8	194.0	127.4	111.6	86.6	2.9	49.3		
1934.....	9.8	48	18	6.2	4	2.3	1.7	8.5	1.2	21.7	4	0	1.2	24.5	111.4	20.7	124.5	99.1	205.8	185.6	103.6	92.0	69.8	3.0	56.2		
1933.....	9.9	49	26	4.5	3	1.0	2.0	1.6	1.3	56.6	1	0	0.9	25.9	102.8	16.8	129.0	103.1	217.5	190.2	103.1	91.1	57.2	2.9	61.6		
1932.....	9.4	45	16	5.4	1.3	3	2.4	1.9	1.6	42.0	3	4	7	22.5	102.1	23.8	116.0	95.3	196.1	174.3	90.6	69.7	62.2	4.0	82.9		
New Jersey:																											
1935.....	10.6	51	(1)	4.8	5	2.5	1.1	2.8	1.2	14.8	3	6	8	52.4	119.2	30.0	100.3	80.6	325.0	302.9	91.0	81.0	56.0	3.3	86.4		
1934.....	11.0	53	(1)	5.2	4	2.0	2.4	1.6	1.4	8.1	2	9	3	56.2	121.1	23.0	107.1	87.7	331.7	309.9	97.6	85.9	60.1	5.1	90.7		
1933.....	10.8	50	(1)	5.4	8	2.9	2.3	1.7	1.8	6	1	7	6	60.0	115.8	30.2	110.6	86.3	303.5	280.8	98.3	82.7	4.8	92.2			
1932.....	10.6	52	(1)	6.3	3	1.5	2.1	4.2	2.6	22.2	4	7	9	65.8	105.9	26.8	107.1	81.9	280.7	248.6	98.7	83.5	58.6	4.4	95.6		
New York:																											
1935.....	12.1	54	23	5.7	4	2.4	2.2	2.9	9	10.4	2	6	2	60.1	140.8	34.3	101.3	78.8	370.2	336.9	119.5	108.4	98.1	6.5	86.2		
1934.....	12.4	58	25	6.0	4	1.0	2.0	1.5	1.2	9.1	5	5	5	62.6	137.5	33.7	76.8	52.6	400.6	343.6	125.9	113.5	71.9	7.1	91.4		
1933.....	11.9	58	26	7.1	4	4.6	2.5	2.6	1.3	16.5	2	9	9	63.2	126.2	32.6	82.7	54.5	364.5	308.3	123.3	111.9	69.4	6.5	78.5		
1932.....	12.2	58	25	6.4	5	2.7	4.5	2.4	2.9	18.4	3	8	1	69.6	125.5	33.6	81.0	55.0	369.6	314.6	136.7	124.6	66.9	5.7	81.1		
North Carolina:																											
1935.....	10.9	72	(1)	6.9	1.1	4.0	1.6	12.7	3.2	49.5	1.5	4	1.2	62.4	51.3	10.7	(1)	(1)	(1)	(1)	(1)	121.4	(1)	16.8	(1)		
1934.....	11.3	83	(1)	7.5	1.7	16.8	0.8	4.5	4.5	31.2	4	3	7	68.6	52.2	11.5	(1)	(1)	(1)	(1)	(1)	137.4	(1)	17.2	(1)		
1933.....	9.8	73	(1)	6.7	2.1	3.6	0.9	6.9	2.7	48.4	2	4	2	67.0	48.6	10.7	(1)	(1)	(1)	(1)	(1)	79.6	(1)	20.2	(1)		
1932.....	9.8	71	(1)	7.5	3.4	2.6	1.0	8.6	3.5	27.2	5	0	8	67.0	44.3	11.6	(1)	(1)	(1)	(1)	(1)	104.3	(1)	15.5	(1)		



## RAT LEPROSY

### Observations Concerning Transmission of the Infection through the Nose

By N. E. WAYSON, *Senior Surgeon, U. S. Public Health Service*, and EICHI MASUNAGA, B. S., *U. S. Leprosy Investigation Station, Honolulu*

The portal of entry through which the micro-organism of the leprosy-like disease of wild rats enters the tissues has not been determined. It has been suggested that it is probably introduced through small wounds in the skin caused by trauma or by the bites of insects. The skin of rats is particularly subject to minor injuries or abrasions produced by biting, scratching, or the plucking of hairs, and it is assumed that the micro-organism may be introduced into these lesions by soiling them with material containing the inoculum. This is thought to be accomplished through the soiling of the teeth or the claws which inflict the wounds, or by bodily contact with the open lesions of infected animals. This belief is perhaps supported to a slight degree by the fact that the infection can occasionally be accomplished experimentally by abrading the skin and rubbing suspensions of the bacteria into it. However, it is to be noted that these suspensions must contain very large numbers of bacteria in order to obtain even a small percentage of infections by this method.

The production of the disease by the introduction of the inoculum through the bites of the ectoparasites common to rats has been attempted by several investigators, including Marchoux (1) and Markianos (2), who have concluded that the infection is not transmitted in this manner. Wherry (3), Currie and Hollmann (4), and Markianos (2) have all reported that they have found acid-fast bacteria resembling the organism of rat leprosy in suspensions made of the crushed bodies of such parasites which had fed on infected animals, but the subcutaneous introduction of such suspensions by Markianos did not produce the infection.

The possibility of the entrance of the organism through the mucous membrane of the nasopharynx seems to have had less consideration. The bacterium has been found to be commonly present in the noses of leprous wild rats in San Francisco and among white rats which were experimentally infected by subcutaneous injections.<sup>1</sup>

<sup>1</sup> The strain of rat leprosy used throughout these experiments was developed in white rats by direct transfer from leprous wild rats in San Francisco. Its identity has been repeatedly checked during this experimentation by its morphology and tinctorial qualities, and by its failure to grow on artificial media and in guinea pigs, as well as by the microscopic and histological changes produced by it in rats.



TABLE 1.—*Number of rats in which acid-fast bacteria were found in the nose*

## LEPROUS RATS

	Wild rats Natural infection			White rats Experimental infection (subcutaneous inoculation)		
	Total examined	Nose positive	Nose negative	Total examined	Nose positive	Nose negative
Skin lesions with ulcerations.....	24	20	4	0	0	0
Skin or lymph node lesions without ulcerations.....	32	22	10	58	48	10
No lesions; <sup>1</sup> bacteria in lymph nodes or skin.....	3	0	3	0	0	0
Total.....	59	42	17	58	48	10

## NONLEPROUS RATS (CONTROLS)

	Wild rats <sup>2</sup>			White rats		
	Total examined	Nose positive	Nose negative	Total examined	Nose positive	Nose negative
No lesions; <sup>1</sup> no bacteria in lymph nodes or skin.....	55	3	52	70	0	70

<sup>1</sup> "Positive" indicates that acid-fasts were found.

<sup>2</sup> "Negative" indicates that acid-fasts were not found.

<sup>1</sup> The axillary and inguinal lymph nodes of the wild rats were those which were regularly examined. Attention was directed to the cervical nodes in the experimental studies at a later date.

<sup>2</sup> These rats came from the same or nearby localities in which the leprous rats were caught.

While there is a likelihood that the wild rat may infect his nose by contact with ulcerated lesions, it is improbable that the subcutaneously inoculated animal does so. It is also unlikely that the inoculated rats had infected their noses previous to the inoculation, since both the test animals and the controls were selected at random from the clean supply stock. Since the organism appears to be so frequently present in the nose, it may be that its dissemination from this site is a natural phase of the life cycle of the parasite. Its introduction into the nose of a new host can be accomplished either through the nosing and licking which goes on between rats, or perhaps through droplet infection, and minute wounds of the skin could thus be readily soiled subsequently. This has been shown by finding acid-fast bacteria resembling that of rat leprosy in the noses of 54 of 75 normal rats kept in small groups in contact with experimentally infected rats in boxes for periods of 3 to 8 months (fig. 1). It seems very improbable that these findings are accidental, since similar bacteria were not found in the noses of 70 control rats which had not had such contacts (table 1). Furthermore, it was observed that nurslings show positive findings after a shorter period of exposure than occurs with older animals, and in general a longer period of exposure of all ages results in a greater number of positive findings. The possibility of spreading the bacterium by indirect methods is

suggested by the findings among groups of normal animals which were kept in cages about 4 inches distant from those containing animals with ulcerated lesions about the face for periods of 3 to 5 months. Acid-fast bacteria were found in 30 of 44 of the exposed groups which were examined.

Among the rats which were held in contact with experimentally infected rats in boxes, 8 were held for 8 months, and their examination included preparations from their cervical lymph nodes. Acid-fast bacteria were found in the cervical nodes of 3 of this group. In 1 of these 3, one node was swollen and adherent to the surrounding structures. Microscopic section of this node revealed a typical rat leprosy granuloma containing large numbers of acid-fast bacteria (fig. 2). These findings suggested the probability of infecting rats by placing the inoculum on the nasal mucous membrane.

During the course of 3 years a number of experiments have been made in which a few drops of a suspension of rat leproma have been instilled once or twice into the nostrils of each of a group of rats without traumatizing the mucous membrane. Ninety-four rats which were inoculated in this manner were subsequently examined. Acid-fast bacteria were found in the cervical lymph nodes in 69 of them (fig. 3). Among 66 which were thus treated and examined 3 or more months later, 58 showed positive findings in the cervical nodes. The larger percentage of negative findings occurred in those groups which were examined after less than 3 months.

Among 1 lot of 8 of the 66, the examinations and findings were as follows: One, 3 months later, with bacteria in mediastinal nodes; four, 7 months later, with bacteria in the cervical nodes; one, 9 months later, with bacteria in the nodes and skin without macroscopic lesions in the skin; one, 11 months later, with bacteria and macroscopic lesions in the skin; one, 15 months later with bacteria in macroscopic lesions generally scattered through the skin and viscera (fig. 4).

In each of two other instillation experiments the bacteria were found in locations remote from the nose. In one animal the bacteria were in mesenteric nodes, and in another they were in lepromata, which developed in the cervical node, in the adjoining neck tissues, and in the lung.

The animals used in these instillation experiments were kept in boxes or cages in which there were no infected animals, but precautions were not taken to avoid all indirect contact through ectoparasites. Examinations were made, however, of other superficial lymph nodes, "axillary" and "inguinal", of 29 of those in which positive findings in the cervical nodes were obtained after 3 or 4 months had elapsed since the nasal instillations. Acid-fasts were not found in any.

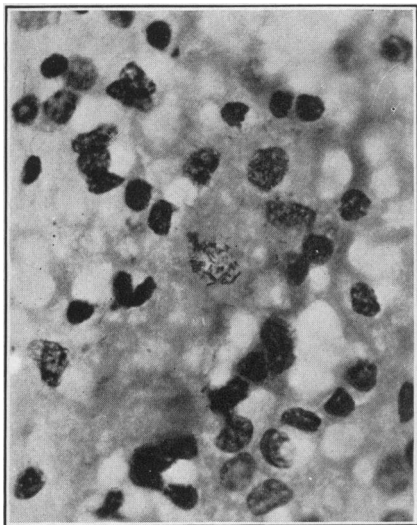


FIGURE 1.—Cluster of acid-fast bacteria in a smear from the nasal mucous membrane of a contact rat.



FIGURE 2 (a).



FIGURE 2 (b).

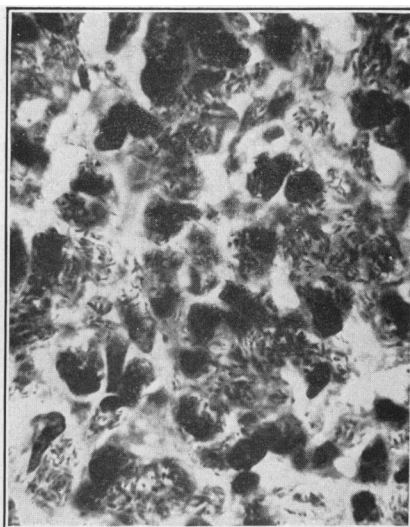


FIGURE 2 (c).

Figures 2 (a), (b), and (c) show three magnifications of a leproma in a cervical lymph node of a contact rat. Figure 2 (c) shows the bacteria in one of the nests of epithelial cells (b) of the granuloma.

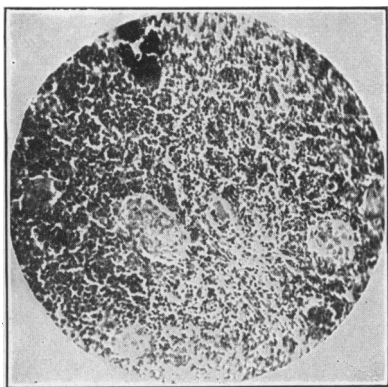


FIGURE 3 (a).

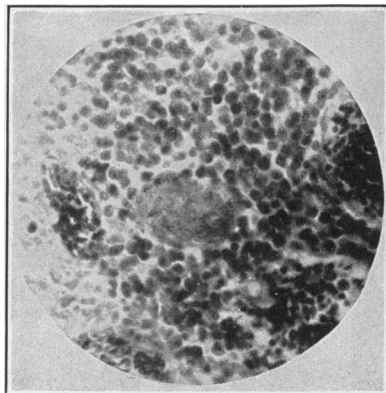


FIGURE 3 (b).

Microscopic lesions (a) and bacteria (b) in a cell of the lesion in the cervical lymph node of a rat into whose nose a suspension of the rat leproma had been instilled. The size of this node was but little, if any, larger than normal, but the node was of firmer consistency.



FIGURE 4 (a).—A portion of the skin of a rat which was infected through the nose. Note the appearance, which is characteristic of natural infections.

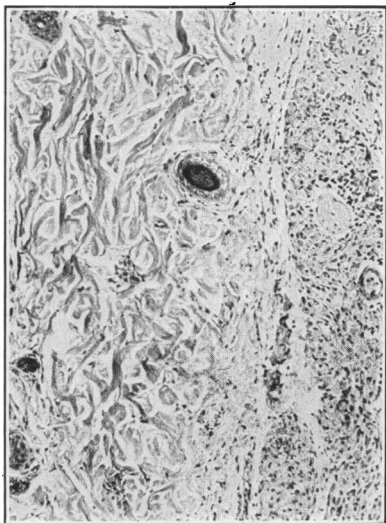


FIGURE 4 (b).—A section of the skin of (a), showing the infiltration typical of rat leprosy.

A final experiment was made in which each of 22 rats were searched for ectoparasites, dusted with pyrethrum, treated by instillation, and held segregated for 3 months as one rat to a box or compartment in a room separated from other experimental work. Dusting with pyrethrum was repeated several times during the 3 months, and but 2 to 4 mites were found on any rat when they were killed for examination. The cervical lymph nodes of 19 of these rats contained acid-fast bacteria when examined at the end of the 3 months' period, but no acid-fast bacteria were found in the axillary or inguinal nodes of any of them, nor were any found in the cervical nodes of 16 uninoculated control rats held in groups in boxes in the same room throughout the period.

#### CONCLUSIONS

Klingmueller (5) states that no one has shown that the bacillus of rat leprosy will traverse the normal nasal mucous membrane of the rat. The observations and findings made in these experiments seem to justify the conclusion that the bacterium will pass through the uninjured nasopharyngeal mucous membrane which is normal from that standpoint. Acid-fast bacteria were commonly found in the noses of rats infected with rat leprosy; and under the conditions of these experiments, the bacterium was transmitted to the noses of normal rats either by direct or by indirect contact with diseased rats, and the disease developed subsequent to a deposit of the inoculum on the mucous membrane without trauma to it.

#### DISCUSSION

The frequency with which infection through the nose occurs in nature among wild rats is unknown. However, the cervical lymph nodes are not commonly the site of macroscopic changes in such infections, whereas the axillary or inguinal nodes are frequently enlarged or exhibit some change. These latter findings would suggest a portal of entry other than the nose. On the other hand the bacteria and microscopic lesions are often found in lymph nodes which do not present gross changes, and it seems highly probable that the microorganisms may pass from such nodes to the circulation without producing macroscopic changes in them. Further observations of microscopic preparations of the cervical lymph nodes of wild rats should be of assistance in determining the frequency with which they are involved, and may thus indicate the frequency with which the infection enters through the nose.

No conclusions are offered from these findings in a leprosy-like disease in rats concerning the processes of leprosy in man. Nevertheless, it seems proper to point out analogous conditions and obser-

variations in the two diseases, since consideration of the similarities which occur in some other diseases of animals has contributed to the knowledge of analogous diseases of man. Both diseases are apparently caused by acid-fast bacteria of comparable morphology, which have not been consistently cultivated in artificial media or in more than one species of host; both diseases are characterized by changes in the blood vessels, the formation of granulomatous infiltrations, extension along contiguous lymph spaces, and by the invasion of the lymph and blood streams by the respective bacteria which may produce granulomatous changes in many localities or tissues of the body, but with a marked selectivity for those of the skin and superficial lymph nodes. The respective bacteria can be demonstrated in or on the nasal mucous membrane in most cases of each disease and in some individual persons or rats in which macroscopic or clinical evidence of disease is not detected. Horcicka, Kitasato, L. Glueck, Roemer, Plumert, Serra, and Zechmeister (6) are all quoted by Klingmueller as having reported the presence of acid-fast bacteria in the noses of those who are in frequent intimate contact with leprosy persons. Sorel and Leboeuf (7) are quoted by Klingmueller, and Marchoux (8) is quoted by Jeanselme as having discovered acid-fasts in the lymph nodes of attendants to leprosy persons, thus suggesting the invasion of the tissues of apparently well people by the bacterium of leprosy. It will be noted that similar observations have been made in rats in these experiments on the leprosy-like disease.

Jeanselme (9) states in a recent publication that no leprologist believes any longer that the habitual route of infection with leprosy is through the nose. He does not cite investigations in substantiation of their viewpoint, and it is believed that further studies should be conducted before this hypothesis is discarded. This latter opinion seems especially pertinent, since the suggestions that different areas of the skin afford all portals of entry are not well supported by clinical or epidemiological experience.

#### SUMMARY

1. Acid-fast bacteria have been found frequently in the noses of wild rats infected with the leprosy-like disease of rats, and likewise in white rats experimentally infected by subcutaneous inoculation.
2. Normal white rats in prolonged direct or indirect contact with infected rats harbored acid-fast bacteria in the nose and developed the disease under the conditions of the experiments.
3. Rat leprosy has developed in white rats subsequent to the instillation of a suspension of rat leproma into the nostril without trauma to the nasal mucous membranes.

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## STUDIES OF SEWAGE PURIFICATION

III. The Clarification of Sewage—A Review <sup>1</sup>

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It is frequently remarked that present-day methods of sewage treatment have greatly outstripped the development of rational theories of plant behavior. This situation, of course, is by no means unique in the general field of practical applications. In sewage treatment, nevertheless, the rationalization of plant procedures has doubtlessly been greatly retarded by the (at times) hopeless outlook of the fundamental problem regarding the quantitative description of reactions between the oxygen-consuming impurities of sewage, at a concentration of approximately 0.001 M, and the various kinds of "activated sludges", also known as "biological slimes" and more accurately described as zoogeal aggregates.

With such unpromising material at hand, it is to be expected that the theories in vogue are generally founded on more or less pertinent analogies with more amenable systems rather than on the direct examination of sewage colloids or bio-colloids. Sustained research, for example, on the various theories of adsorption as a mechanism for the removal of organic matters from sewage by sludges becomes impossible when no absorption is observed, using sludge drawn from an activated sludge plant. Likewise, the evaluation of various theories of colloidal precipitation is a discouraging task when the sewage colloids refuse to agglomerate or when the agglomerated solids decline to settle. The development of biological theories is greatly hampered by unsurmounted difficulties in the matter of cultivating protozoa and allied organisms in pure culture; bacterial counts may fail to yield more than 1 percent of the organisms present

<sup>1</sup> This is the first of a series of papers summarizing the studies of adsorption by activated sludge conducted at the stream pollution investigations station of the United States Public Health Service, Cincinnati, Ohio.

in the sludge. Theories of enzymatic action have frequently been advanced, but in no case have the hypothetical clotting, lytic or oxidative agents been produced.

In another sense, the present unsatisfactory state of the sewage problem is closely related to the controversy, as reviewed by Wilson (1930), "over the imagined respective functions of the biological and physical agencies." No single theory has been proposed which will account satisfactorily for all of the diverse phenomena of sewage treatment. In general, the physical or colloidal theories have explained the purification of sewage either by the coagulation of the sewage colloids in various ways or else by the absorption of the organic matters on the sludge, to the frequent neglect of the subsequent biological oxidation of the coagulated or absorbed impurities. On the other hand, this preliminary process of clarification has often been ignored or even denied by the proponents of the biological theories.

It is to be surmised that the various theories of sewage purification do not all possess an equal degree of credibility. Nevertheless it is safe to assume that biological oxidation in some form must necessarily be considered in any general theory of sewage purification by the usual processes. Greater uncertainty exists as to the validity of the clarification concept. For the purposes of the present discussion, leading to the presentation of a new theory of sewage clarification, the review of the scattered literature will therefore be devoted largely to the phenomenon of clarification as a process preliminary to and distinctly separated from the subsequent process of biological oxidation.

#### EARLIER THEORIES

The earliest recorded scientific investigation of sewage treatment is probably that of Frankland (1868) with the British Rivers Pollution Board. Working under laboratory conditions, with glass cylinders, Frankland gave the first clear-cut demonstration of the role of atmospheric oxygen in the purification of sewage and laid the foundation for the principle of "intermittent filtration." Frankland assumed that the dissolved organic matters of sewage were oxidized by the oxygen of the air as the sewage dripped through a filter or a porous soil.

With the recognition of the biological character of filter growths, the simple theory of direct oxidation advanced by Frankland became untenable. The numerous reports of the Lawrence Experiment Station (1887 et seq.) are to be consulted for the development of theories of direct biological oxidation of organic matters in the *slow* passage of the sewage through a filter. Commenting on these earlier observations Dunbar (1908, pp. 121-122) says: "If Frankland's experiments are to be regarded as the basis of modern biological methods of sewage treat-



ment, they have really attained this position with the aid of the systematic and scientifically conducted experiments of the Massachusetts State Board of Health."

Dunbar's classical experiments were conducted at the Hamburg Hygienic Institute (1897-1900). He considers that the oxidation of sewage matters in their slow passage through a filter was a possible explanation " \* \* \* so long as it could be maintained that sewage remained about 3 days in the filter; but when it was shown that the sewage left a 3-foot filter thoroughly purified within 10 minutes \* \* \* the above explanation fell to the ground. It cannot be assumed that micro-organisms decompose highly complex molecules of organic substances within a few minutes or seconds \* \* \*. It can only be assumed that the dissolved organic matters are first separated from the sewage during its passage through the filter, and are retained in the filter to be decomposed and oxidized by the micro-organisms during the succeeding period of rest." After examining theories of mechanical retention and of chemical combination, Dunbar concludes that "an explanation of the purification process must be sought in absorption phenomena."

The general theory of filter action proposed by Dunbar, and systematized by Ardern (1921), was somewhat as follows:

1. Coarse particles are transferred to the filtering media by surface attraction.
2. Dissolved matters are retained by adsorption phenomena accelerated by the growth of a biological slime on the filter materials.
3. The absorbed materials are oxidized by biological action and also by oxygen "ozonized by the high pressures existing in the gelatinous film."
4. The absorption process is prevented from ceasing by the action of micro-organisms under aerobic conditions.
5. There is a residue of organic matter, highly resistant to bacterial action, which either accumulates in the filter or is discharged with the effluent.

Dunbar's concept of the action of sewage filters is therefore properly described not simply as an "absorption theory" but rather as a well-balanced summary of the then existing knowledge regarding sewage purification.

Stoddart's criticism of Dunbar's theory will serve as an illustration of objections brought to bear against absorption as a step preliminary to biological oxidation. "It has already been shown that the starting point is the assumption that micro-organisms cannot 'decompose highly complex molecular organic substances within a few minutes or seconds' \* \* \* and with the exposure of the fallacious nature of this assumption, which may be characterized as an unwarrantable repression of scientific imagination, the theory itself falls to the

ground." (Stoddart, 1909, p. 201.) Stoddart's experiments controverting Dunbar's absorption theory were based on comparisons of rates of flow through filters of solutions of sodium chloride and of ammonium chloride. It will be shown in subsequent papers of this series that the absorption of ammonium chloride should be prevented by the sodium chloride, unless special precautions should be observed. It is also possible that the absorptive capacity of Stoddart's filter was exceeded. It must be admitted, nevertheless, that Dunbar's theory when first proposed was by no means free from objections, particularly in the matter of the removal from sewage of dialyzable or noncolloidal matters such as ammonia.

Biltz and Krohnke (1904), in their important paper on the first definite recognition of the colloidal nature of sewage, list three methods whereby the clarification of sewage may be accomplished. Chemical precipitation is represented by the use of ferric salts. Biological methods of sewage treatment are regarded as affording a means for the formation of absorption compounds between the colloids of sewage and the slimy, gelatinous coatings of the filter materials. These biological slimes, however, are regarded simply as colloid surfaces. The bacteria themselves, although identified with the biological slimes, are regarded as precipitants in reversed analogy to agglutination. The mechanical theory proposed by Biltz and Krohnke is referred by them to the absorption theory of Dunbar and earlier writers; they do claim, however, to have established a rational connection between the nature of the sewage and the methods of clarification. As to the fate of the absorbed materials, it was assumed that they might be oxidized by the action of "ferments" or else directly (unmittelbar) by atmospheric oxygen, "at all events essentially by purely chemical means." (*cf.* Jones and Travis, 1906, pp. 72 and 161.) This unsubstantiated part of the theory advanced by Biltz and Krohnke does not detract greatly from their demonstration that, ahead of corrections, at least one-third to one-half of the sewage matters are present as colloids.

Jones and Travis (1906), in their widely discussed paper on the clarification of sewage by filters at Hampton (England), advanced a somewhat different theory for the "de-solution" of sewage colloids. They maintain that the deposition of solids on the filter materials "is dependent upon the action of surfaces, as such", and not on the colloidal properties of the biological slimes. The efficiency of a filter should therefore be increased by the use of finely divided material. Jones and Travis (1906, p. 192, discussion) were afterwards willing to concede to Biltz and Krohnke, and also to H. W. Clark of the Lawrence Experiment Station, that "\* \* \* colloids in gel form encouraged further deposition, and to this extent the bacterial coating of the (filter) material undoubtedly played a part."

Biochemical oxidation was practically disregarded by Jones and Travis (1906) and, as pointed out by Wilson (1930), could properly be omitted if their theory was restricted to sewage clarification. The claim that "the bacteria play only a subsidiary part in the purification" was, nevertheless, highly objectionable to proponents of biological theories. The view of bacterial purification held by Jones and Travis was clearly an expectancy of sludge liquefaction. "In Hampton, at the outset, absolute confidence was reposed in voracious capacity of the bacteria. Indeed, the announcement was made that the solids of sewage would all be 'eaten by the organisms'", thereby preventing the clogging of a relatively fine (0.5-inch) filter. Disillusionment in respect to the hydrolysis of the highly resistant sludge humus by micro-organisms is caustically expressed in the quoted statement, "The best organism I have at the sewage-works is the man with a barrow" (*cf.* Dunbar).

Although the so-called "Hampton doctrine" of Jones and Travis is frequently contrasted with the more general theory of Dunbar, it is clear that the views expressed by these workers, and also by Biltz and Krohnke, are in substantial agreement as to the mechanism for the primary removal of suspended or colloidal matters from sewage. In each case a purely physical theory is proposed, which does not account for the removal of matters in true solution, such as ammonia, sugar, etc. The Dunbar theory, however, does make suitable provision for the subsequent oxidation of the absorbed materials. The introduction of the time element, with its implication of preliminary absorption instead of direct oxidation by atmospheric oxygen or direct action by bacterial cells, must be regarded as Dunbar's greatest contribution to the sewage problem.

#### RATE OF CLARIFICATION

While it is plausible or even necessary to assume that some preliminary process of absorption must be operative in the clarification of sewage, it was by no means easy to separate this process from the accompanying process of biological oxidation when methods of sewage treatment were restricted to contact beds or trickling filters. The phenomenon of clarification may nevertheless be readily demonstrated by a suitable arrangement of parts in biological oxidizing devices utilizing "activated sludges" as absorbents. The experiments of Theriault and McNamee (1930) will serve as an example.

Using a biological device, designed to simulate a small stream with polluted water trickling over slime-covered stones, it was shown at the Stream Pollution Investigations Station of the United States Public Health Service that, starting with a grossly polluted water, the production of a highly clarified effluent could be effected in a period of

flow of about 20 minutes. The apparent reduction in the incoming pollution, neglecting absorption, was of the order of 90 percent. For polluted waters incubated under laboratory conditions, in the absence of deposited sludge, an equivalent degree of actual purification by biological oxidation could be accomplished only in 10 days, under comparable temperature conditions. The term "clarification" will be used in referring to the marked over-all improvement which results when sewage is treated for a brief period of time with certain biological slime growths, the so-called "activated" sludges. The term "purification" is properly restricted to the relatively slow but none the less effective process of biological oxidation. It is obviously desirable to distinguish clearly between these two methods whereby the pollutional characteristics of a sewage may be diminished.

Reference will again be made to these experiments later in this paper. Their particular virtue lies in the fact that the time element was very clearly defined and, also, that the tests were conducted on a semiplant scale in close approximation to natural conditions. It is reasonable to assume that the phenomenon of clarification demonstrated in these experiments is identical with the rapid improvement noted in trickling filters, contact beds, and similar devices where the control of experimental conditions offers many difficulties. In each case, however, it is certain that biologically active sludge is present and it can be assumed that the period of contact is brief, although divergent opinions on this particular point have been expressed.

Clarification, likewise, undoubtedly occurs in the activated sludge process, where the biological slimes are blown through the sewage instead of remaining adherent to stones as in processes of filtration. The time element in the activated sludge process can only be estimated with difficulty in an actual installation. Activated sludge, nevertheless, is admirably adapted to laboratory experimentation, and several workers have reported on its clarifying power under controlled conditions.

In the discussion following the paper by Young and Melling (1918, p. 19), Garfield refers to the experiments of Barraclough in which a reduction of about 50 percent in permanganate oxygen consumed, together with a decrease in free ammonia, was observed in absorption experiments where samples were taken "immediately" after mixing activated sludge with sewage. "The first point was that the activated sludge, upon being mixed with the sewage, immediately effected a purification which might be compared with the action of a very heavy chemical precipitant, \* \* \*." Barraclough evidently was dealing with a very "good" sludge.

Cambier (1920) presented experiments indicating that the removal of the colloidal matters of sewage, together with the ammonia, is effected from the very start of the contact period with activated

sludge, although not at the first instant of contact as interpreted by Butler and Coste (1927). In work with fresh sludge approximately 50 percent of the ammonia was absorbed in 15 minutes, without any corresponding indication of nitrification.

Butler and Coste (1927) were unable to confirm the claims of Cambier regarding the fixation of ammonia by activated sludge, although they did find a marked "at once" action of activated sludge upon sewage. The average improvement, measured in terms of permanganate oxygen consumed, was about 29 percent when the period of contact was reduced to the minimum consistent with good mixing. "We think that the ability to produce a stable supernatant or filtrate as an immediate result of mixing activated sludge with sedimented sewage might constitute a test of activity of activated sludge."

Herb (1928) found that the oxidizability of the supernatant liquor was reduced by about 16 percent when a sewage was aerated for 5 minutes in the presence of 25 percent of activated sludge by volume. A steady state corresponding to 50 percent reduction was reached in about 30 minutes.

Theriault and McNamee (1930) reported a reduction of about 65 percent in the oxygen demand of a sewage following 10 minutes of agitation with a biological slime under laboratory conditions. This corresponds to the 90-percent reduction in 20 minutes observed under plant conditions.

Parsons (1929) could not obtain more than a slight "instantaneous effect" in his sewage clarification experiments using activated sludge as an absorbent. He suggests that the results of Butler and Coste may be in error because of an intervening filtration. Parsons, nevertheless, did obtain a marked improvement in his equilibrium experiments using a 30-minute period of agitation.

Grant, Hurwitz, and Mohlman (1930, p. 240) present a very consistent set of absorption curves, indicating a reduction of about 80 percent in oxygen requirements in 40 minutes, with little change when the aeration of the sludge-sewage mixtures was extended to 160 minutes.

Seiser (1928) concluded that the absorptive capacity of fully aerated activated sludge is largely exhausted in less than 1 hour.

The discrepancies in the graded series of observations just reviewed are probably more apparent than real. Negative results for the removal of ammonia, even though organic matters were readily removed, are satisfactorily explained by Butler and Coste (1927) on the basis that the sludge used in their experiments was drawn from a plant in which the second or nitrification stage of biological oxidation had not yet been fully established. As shown by complete deoxygenation curves, ammonia was not removed in the laboratory

experiments of Theriault and McNamee (1930) using sludge drawn from the upper sections of their artificial stream. Ammonia was readily removed, however, at "downstream" sections of the same installation.

Values reported by different observers for the percentage removal of organic matter from a given sewage cannot, of course, be compared without reference to the strength of the sewage, the absorptive capacity of the sludge, and other factors. The "at once" effect noted by Barracrough, and also by Butler and Coste, does not exclude later manifestations of the same phenomenon continued at a diminishing rate as the exhaustion of clarifying power is approached.

Negative results are seldom reported in the literature but they nevertheless have generally been obtained by the writer in preliminary experiments with sludges which are now believed to have been already fully saturated with sewage matters. It should obviously be desirable to work with fully activated or regenerated material in any attempted demonstration of the clarification process. With these explanations, it must be concluded that the evidence regarding the existence of a very rapid process of clarification is reasonably definite. If the phenomenon in question does occur with a given sludge, it should be completed in 30 or 40 minutes when pushed to the limit of the absorptive capacity of the sludge.

It is necessary to keep this definition clearly in mind so as to distinguish between clarification, as such, and the subsequent reactivation of the sludge or the regeneration of its clarifying power through the biological oxidation of absorbed materials. The statement that "2 or 3 hours are required for clarification by the activated sludge process" should be interpreted as including time for the period of regeneration. Clarification in the sense of turbidity removal, as by bacteria-eating plankton, is yet another phenomenon which is probably never completed in 30 or 40 minutes. On the other hand, the clarifying action of chemical precipitants may be regarded as closely related to the phenomenon under consideration. At all events the term "clarification" will be used only in the relative sense and not in the absolute sense with its connotation of complete removal of turbidity. A sewage may still remain quite turbid when clarified to the extent of 29 percent as in the experiments of Butler and Coste.

#### MECHANISM OF SEWAGE CLARIFICATION

Having shown the relation of clarification to the general theory of sewage treatment, and having presented the evidence regarding the validity of this useful concept, it will now be of interest to look more closely into some of the suggested explanations of the associated phenomena.

Mention has already been made of the explanation offered by Biltz and Krohnke for the efficacy of ferric salts in the precipitation of sewage colloids which, on the basis of migration experiments, had been shown to be negatively charged. It is to be noted that these experiments refer to the sewage colloids and not to the sludge. Surface attraction was suggested by Dunbar, and also by Jones and Travis, as a mechanism for the removal of the coarser or suspended matters by filter materials or by deposited sludge.

Theories of mutual coagulation of sewage colloids by the neutralization of electrical charges have frequently been advanced, in distinction to precipitation by outside agencies. With due regard to conventions regarding electrical charges, Cavel (1931), for example, reports that negative colloids, such as Congo red, are absorbed by activated sludge. Hence the sludge must be positively charged and, by further inference, the sewage colloids should be negatively charged. Dienert (1922) is less definite in his statement that the sewage colloids seem to be negatively charged while the sludge itself appears to be positively charged. Buswell (1928, p. 319) says: "One serious objection to the colloidal theory of coagulation is that the colloidal particles in sewage and the activated sludge particles are, so far as we are able to determine, both negatively charged. Since adsorption of colloids is most effective between oppositely charged particles, it should not be applied to the conditions of the activated sludge particles without reservation." Baly (1931) considers that, were it not for this observation of Buswell and Long (1923), the most attractive theory concerning the mutual coagulation of sewage and sludge colloids by the neutralization of electrical charges, "would seem to be one that could offer a completely satisfactory explanation of the activated sludge and activated filter bed processes of purification." To avoid this difficulty Baly (1931) has proposed a theory in which, as reported by Lumb (1933), it is assumed "that weakly charged colloidal particles will associate with strongly charged bacteria of the same sign, because the free energy of the whole system is thereby decreased." It should be incorrect to conclude that, by one theory or another, sewage colloids will always be mutually coagulated, regardless of sign.

In criticism of the colloidal theories of sewage precipitation it should be recalled that the suspended matters of sewage are by no means all of colloidal dimensions. Moreover, the colloidal theories at best cannot account for the removal of the considerable proportion of the nitrogenous and other oxygen-consuming impurities which are present in true solution. The presence of bacteria in the sludge particles should not be regarded as evidence of a transfer of the micro-organisms from the sewage to the sludge. Local growth on the favorable medium afforded by the sludge is to be considered.

The actual removal of bacteria from the sewage liquor may be largely accomplished by bacteria-eating plankton. It is not clear, moreover, that the previous history of the sample has always been considered in determining the character of electrical charges on activated sludges. The pH value of the liquid is often disregarded and the magnitude of the electrical charge appears to have been generally ignored, except by Baly.

From another angle it must be considered that the Baly theory, as applied to sewage colloids, does offer an explanation for the agglomeration of sewage colloids akin to the growth of drops by distillation from smaller to larger ones or, for that matter, to the growth of precipitates, as in water purification, from the stage of barely recognizable turbidity to the condition of visible "flocs."

In this case there can be no question as to the phenomenon itself and, furthermore, it must be considered that all of the particles composing the flocs originally possessed the same electrical sign. It appears reasonable, therefore, to assume a similar mechanism for the agglomeration of sewage colloids into sludge particles. Separate consideration should be given to the absorption of other organic matters by the sludge particles.

The biological theories of clarification are so intermingled with notions of oxidation that mechanisms for the rapid removal of organic matters from sewage are frequently obscured, although Johnson (1914, pp. 130-1), with reference to the action of the upper portion of a filter receiving crude sewage, is reasonably definite in his statement that "The filter material rapidly becomes coated with a slimy or gelatinous growth of *Zooglea ramigera*, which may be regarded as a large number of bacteria embedded in a gelatinous matrix." The gelatinous character of these zooglear formations enables them to "absorb *soluble* polluting substances—as already described in Dunbar's absorption theory." The functions of a different class of filter organisms are emphasized by Buswell (1928, p. 331): "As indicated in the previous discussion, there are two groups of reactions which take place in trickling filters, (a) bioprecipitation and, (b) oxidation, or nitrification, as the latter is usually called. Bioprecipitation is accomplished by the larger organisms, the chlamydobacteriaceae or 'giant bacteria', the fungi ('especially molds'), the larger protozoa, and certain higher animals. These organisms are found to compose the bulk of the growths on the filter stones. A certain amount of oxidation is accomplished incidentally by these organisms, since they give off carbon dioxide."

With particular reference to the activated sludge process, the "Bioprecipitation Theory" is described as follows: "In view of previous work of other authors cited and the data of the present paper, we wish to propose the following statement of the theory of the activated



sludge process. Activated sludge flocs are composed of a *synthetic* gelatinous matrix similar to that of Nostoc or Merismopedia, in which filamentous and unicellular bacteria are embedded and on which various protozoa and some metazoa crawl and feed. The purification is accomplished by ingestion and assimilation by organisms of the organic matter in the sewage and its resynthesis into the living material of the flocs. This process changes organic matter from colloidal and dissolved states of dispersion to a state in which it will settle out" (Buswell and Long, 1923). Buswell (1931) describes activated sludge as follows: "The animal inclusions of the sludge made up a very small part of the entire mass. The base of the sludge was composed of zooglycal masses intermixed largely with filamentous bacteria and occasional *Zooglyca ramigera*." The surface area afforded by the zooglycal masses is estimated to be at least 500 square feet per cubic foot of aeration chamber. The importance of the zooglycal masses of bacteria has also been pointed out by Taylor (1930), and more recently the cultural and other characteristics of these gelatinous formations have been studied by Butterfield (1935) in this laboratory.

Buswell (1928, pp. 318-319) states that "there is practically no absorbed precipitated or coagulated amorphous matter in these sludge particles, but that they are composed entirely of active, growing microscopic organisms \* \* \*. From what we know of the metabolism of micro-organisms it is probable that the unicellular forms absorb through their membrane such soluble forms of organic matter as are able to pass through this membrane, and that they also secrete enzymes which are capable of peptizing or liquefying colloidal particles too large to be directly absorbed. Protozoa, on the other hand, can easily be seen to approach and ingest visible particles of organic matter." The claim that activated sludge contains "practically no absorbed, precipitated, or coagulated amorphous matter" evidently refers to the fully activated material and not to sludge recently exposed to sewage matter. Likewise, the assumption that the sludge particles "are composed entirely of active, growing microscopic organisms" implies that the zooglycal masses, as a whole, are endowed with animate energy. As these gelatinous masses have been studied only bacteriologically, such a concept of zooglycal activity, although generally accepted, has probably accrued by default.

Parsons (1929) proposed an enzymatic theory coupled with "direct cell action" in explanation of the rapid removal of organic matters in sewage clarification. The protozoa are not mentioned, and as it appears unlikely that colloidal matter is taken up directly by bacteria, enzymes are introduced to account for the breaking down of larger particles. Substances in true solution are then transferred to the living organisms by osmosis. Parson's hypothetical enzyme, like

Buswell's is a lytic agent and not the clotting enzyme of the earlier chemists.

"Direct cell action" is assumed in Parson's theory of clarification as well as in the older theories of biological action. It is difficult, however, to visualize "direct cell action" by bacteria, because of the intervening gelatinous matrix in which most of the bacteria are embedded. On the other hand, "direct cell action" by the protozoa, etc., is an undeniable fact. Thus it is certain that to some extent the coarser particles of raw sewage are attacked and disintegrated by various species of plankton. Furthermore, the comminuted material may be visibly ingested by these relatively large organisms. By "coarser particles" in this connection are meant particles barely visible to the unaided eye. Suspended matters of greater dimension are, of course, infrequent even in crude sewage and they should be absent from the screened or settled sewage actually applied to filters or mixed with activated sludge.

Opinions as to the importance of protozoa in the clarification of sewage have ranged from the emphatic views of their usefulness expressed by Cramer (1931) to the suggestion by Fairbrother and Renshaw (1922) that the protozoa in activated sludge might be eliminated through the use of certain dyes because of their interference with the process. Butterfield, Purdy, and Theriault (1931) have held that the primary function of the protozoa is to prevent the bacterial population from reaching a stalemate, thereby stimulating bacterial growth with accompanying oxidation. The validity of the more restricted theories of biological action is nevertheless conditioned by the fact that the clarification of sewage, as defined in this paper, cannot very well be credited to the activities of either the bacteria or the protozoa. The action of the protozoa in the disintegration of coarser food particles and in the removal of bacteria from the sludge liquor must be regarded as a continuing process which is certainly not circumscribed by any 30-minute limitation. In the practical absence of quantitative data, the most favorable view of the matter would be to credit the protozoa with the removal of the excess population of bacteria from the body of the liquid. In this sense the protozoa should be credited with a secondary clarifying effect. The disintegration of coarser particles is probably accomplished by the protozoa only after these suspended matters have been agglomerated as a result of the primary clarification of the sewage.

As to the action of enzymes in the disintegration of coarser particles, it is tempting to replace Parson's hypothetical lytic agent by the protozoa, although bacterial enzymes are specifically mentioned by him in his important paper. Endoenzymes may account for the intracellular liquefaction or lysis of ingested food particles. There

is no evidence, however, of the existence of exocellular enzymes capable of liquefying suspended matter in 30 minutes or thereabouts. From the nature of the sludge floc any enzymes liberated by the bacteria, unless greatly diluted, should be stored in the gelatinous matrix. Lytic action should only be expected after the suspended matters have been collected on the floc. It should also be considered that the definite isolation of enzymes from the sewage or sludge has never been accomplished.

Theriault and McNamee (1930), in experiments already referred to, investigated the possibility that the extraordinary rate of apparent purification or clarification which obtained in their artificial stream was in reality an oxidation induced by the presence of a relatively high concentration of enzymes in the biological slime (sludge mat) deposited on the stream bed. The hypothetical enzyme visualized in these experiments was therefore an oxidase and not a clotting nor a lytic agent. Clarification by bacteria, or by combinations of bacteria and plankton, had been ruled out by known facts concerning their rates of oxidation. Reasons existed, however, for suspecting the existence of a more rapid oxidation process, loosely described in terms of the then ill-defined "immediate" oxygen demand of sewage and of sludges and tentatively ascribed to enzymatic action. Using the apparatus described by Theriault and Butterfield (1929), complete deoxygenation curves were accordingly obtained from which the respective rates of satisfaction of the "immediate" oxygen demand and of the oxygen demand related to biological activity could be deduced.

TABLE 1.—*Oxygen demand of sludge*

Period of incubation	Hours									
	1	2	4	6	11	23.5	29.5	47	74	95
OXYGEN DEMAND—P. P. M.										
Rapid process ( $Y_1$ ).....	26	49	86	113	154	185	188	190	190	190
Slow process ( $Y_2$ ).....	8	16	32	48	87	177	217	325	465	556
Sum ( $Y$ ).....	34	65	118	161	241	362	405	515	655	746
Observed.....	35	59	120	150	246	356	399	513	663	740

<sup>1</sup> Calculated by the formula,

$$Y = Y_1 + Y_2 = 190.3 (1 - 10^{-0.002271}) + 1088.2 (1 - 10^{-0.00008}).$$

As shown in table 1, the disappearance of atmospheric oxygen could very accurately be described in terms of two concurrent reactions, the slowest one corresponding to the normal rate of bacterial oxidation and reaching an asymptote in 20 days, and a much faster reaction which, however, was only completed in 20 hours or thereabouts. The results were therefore disappointing in respect to the existence of a major oxidation process which proceeded to 90 percent

completion in 20 minutes. The experimental conditions in these experiments were such that the conclusions as to the rates of oxidations could be checked by striking a very satisfactory balance between the observed decrease in the organic matter content of the sewage and the increased oxygen demand of the sludge mat. It is significant that the rate of bacterial oxidation deduced from these experiments accords satisfactorily with that observed in repeated experiments with river waters. The rate of satisfaction of the so-called "immediate" demand does not exclude certain types of enzymatic action. The assumption regarding the presence of exo-cellular enzymes in the sludge mat therefore remains a plausible but undemonstrated possibility. The existence of this relatively rapid process of oxidation is undeniable, and the same effect has since been repeatedly observed with sludge drawn from an activated sludge plant.

Absorption effects were invoked by Theriault and McNamee (1930) in explanation of the rapid clarification of sewage by activated sludges.

#### SUMMARY

It is apparent from the foregoing review that definiteness of statement in regard to the various phenomena of sewage treatment implies a recognition of the all-important element of time. With the information at hand regarding underlying rates, it has become possible clearly to separate the basic phenomena of sewage treatment into processes which approach completion, respectively, in days, hours, or minutes. On this basis, it is evident that the participation of the biological elements as a major factor in the primary clarification of sewage is definitely ruled out, unless the difficult hypothesis is introduced of direct absorption by bacteria, etc., without accompanying oxidation. If the clarification process is referred to enzymatic action or to the activities of protozoa, it is still necessary to provide a mechanism for the rapid transfer of organic matters to the enzyme substrate or to the protozoan nidus, in either case, the sludge floc.

From various angles, therefore, attention should be focused on the floc itself as the primary absorbent, apart from embedded bacteria, secreted enzymes, or attending protozoa. Such a view of sewage clarification, while plausible enough, raises a difficult question in regard to the nature of the gelatinous matrix which has hitherto been generally regarded as an indissoluble component of the bacteria. New light on this seemingly intractable problem is afforded by the recent announcement (PUBLIC HEALTH REPORTS, Feb. 1, 1935) that the adsorbent principle in activated sludge had been definitely identified as a base-exchanging substance, chemically the same as the zeolites of water purification. The data substantiating this proximate analysis of the gelatinous matrix in activated sludge will be

presented in the next paper of this series. A discussion of numerous and more or less obvious implications as regards the theory or practice of sewage treatment will be given in succeeding papers.

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**DEATHS DURING WEEK ENDED OCT. 19, 1935**

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Oct. 19, 1935	Correspond- ing week, 1934
<b>Data from 86 large cities of the United States:</b>		
Total deaths.....	7,865	7,836
Deaths per 1,000 population, annual basis.....	11.0	10.9
Deaths under 1 year of age.....	493	597
Deaths under 1 year of age per 1,000 estimated live births.....	45	56
Deaths per 1,000 population, annual basis, first 42 weeks of year.....	11.4	11.3
<b>Data from industrial insurance companies:</b>		
Policies in force.....	67,783,476	67,015,611
Number of death claims.....	11,498	12,803
Death claims per 1,000 policies in force, annual rate.....	8.8	10.0
Death claims per 1,000 policies, first 42 weeks of year, annual rate.....	9.7	9.9

# PREVALENCE OF DISEASE

*No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring*

## UNITED STATES

### CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended Oct. 26, 1935, and Oct. 27, 1934

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Oct. 26, 1935, and Oct. 27, 1934*

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934
New England States:								
Maine.....		2		1	45	4	0	0
New Hampshire.....						1	0	0
Vermont.....	3				32	2	0	0
Massachusetts.....	11	17			53	27	5	1
Rhode Island.....		3			4		0	0
Connecticut.....	6	3		1	58	51	0	0
Middle Atlantic States:								
New York.....	34	46	17	10	234	122	6	3
New Jersey.....	20	10	3	12	23	19	0	0
Pennsylvania.....	49	70			53	256	4	2
East North Central States:								
Ohio.....	95	111	9	45	58	104	3	0
Indiana.....	99	100	27	28	6	66	3	1
Illinois.....	84	118	16	8	20	132	5	3
Michigan.....	8	16	3	2	22	37	1	2
Wisconsin.....	5	8	26	6	55	117	1	2
West North Central States:								
Minnesota.....	6	10		1	14	60	2	0
Iowa.....	28	18	3		2	11	2	2
Missouri.....	93	87	42	17	26	72	3	1
North Dakota.....	7	4			3	33	0	0
South Dakota.....	4				3	4	0	0
Nebraska.....	16	16			40	1	0	0
Kansas.....	12	3	3	2	3	50	0	0
South Atlantic States:								
Delaware.....		4		1	56		0	0
Maryland.....	10	9	6	16	7	9	2	2
District of Columbia.....	18	8	1			2	4	0
Virginia.....	82	164			15	118	4	1
West Virginia.....	66	92	16	18		46	2	0
North Carolina.....	124	138	8	8		30	2	1
South Carolina.....	13		185		6	2	3	0
Georgia.....	57	71					0	0
Florida.....	24	14			1	2	0	0

See footnotes at end of table.

*Cases of certain communicable diseases reported by telegraph by State health officers  
for weeks ended Oct. 26, 1935, and Oct. 27, 1934—Continued*

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934
<b>East South Central States:</b>								
Kentucky.....	74	78	9	11	65	4	0	2
Tennessee <sup>1</sup> .....	72	80	22	18	2	43	4	0
Alabama <sup>2</sup> .....	45	62	36	17	9	26	1	0
Mississippi <sup>3</sup> .....	36	27					0	0
<b>West South Central States:</b>								
Arkansas.....	22	23	12	4	2		0	2
Louisiana.....	28	38	12	3	13	11	0	2
Oklahoma <sup>4</sup> .....	25	19	16	28	2	1	2	3
Texas <sup>5</sup> .....	170	75	153	129	7	39	3	3
<b>Mountain States:</b>								
Montana.....	4	4	5	4	10	47	0	0
Idaho.....	1	10	2	3			0	1
Wyoming.....	1					3	0	0
Colorado.....	18	11			18	48	0	2
New Mexico.....	7	3	2	4	8	19	0	0
Arizona.....	8	1	29	5	2	20	6	0
Utah <sup>1</sup> .....	1				1	5	0	0
<b>Pacific States:</b>								
Washington.....	3	2			88	106	1	0
Oregon.....	1		21	23	108	7	1	0
California.....	65	42	24	19	137	156	2	2
<b>Total</b> .....	1,555	1,617	698	444	1,317	1,912	66	38
<b>First 43 weeks of year</b> .....	27,581	29,823	108,928	53,887	702,700	678,037	4,793	1,937

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934
<b>New England States:</b>								
Maine.....	6	2	22	15	0	0	2	9
New Hampshire.....	0	0	9	9	0	0	0	0
Vermont.....	4	0	5	9	0	0	1	1
Massachusetts.....	35	2	120	122	0	0	2	2
Rhode Island.....	7	0	12	8	0	0	1	1
Connecticut.....	9	0	44	25	0	0	1	2
<b>Middle Atlantic States:</b>								
New York.....	45	7	271	251	0	0	10	26
New Jersey.....	22	0	68	91	0	0	1	5
Pennsylvania.....	1	4	291	338	0	0	14	17
<b>East North Central States:</b>								
Ohio.....	0	6	290	388	2	0	25	36
Indiana.....	4	3	125	121	3	2	7	12
Illinois.....	12	15	392	343	5	6	20	32
Michigan.....	14	5	139	196	0	1	9	16
Wisconsin.....	1	17	275	365	4	7	4	10
<b>West North Central States:</b>								
Minnesota.....	0	1	151	57	0	16	3	1
Iowa.....	1	1	82	50	4	3	10	10
Missouri.....	1	0	143	70	0	0	16	17
North Dakota.....	1	0	28	30	0	0	8	4
South Dakota.....	2	1	42	9	12	0	1	0
Nebraska.....	0	0	35	21	5	3	0	0
Kansas.....	1	4	88	47	2	3	5	4
<b>South Atlantic States:</b>								
Delaware.....	0	0	4	11	0	0	4	4
Maryland <sup>2</sup> .....	1	0	81	106	0	0	16	9
District of Columbia.....	3	0	13	18	0	0	2	3
Virginia.....	4	4	68	127	0	2	29	22
West Virginia.....	0	2	173	155	0	0	10	25
North Carolina.....	3	0	135	151	0	1	8	6
South Carolina.....	1	0	7	15	0	0	5	12
Georgia <sup>3</sup> .....	0	1	23	33	0	0	13	7
Florida <sup>4</sup> .....	1	0	7	4	0	0	0	3

See footnotes at end of table.



*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Oct. 26, 1935, and Oct. 27, 1934—Continued*

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934	Week ended Oct. 26, 1935	Week ended Oct. 27, 1934
<b>East South Central States:</b>								
Kentucky.....	7	3	77	76	0	0	12	19
Tennessee <sup>1</sup> .....	1	1	87	93	0	0	13	26
Alabama <sup>2</sup> .....	1	3	14	33	0	0	11	14
Mississippi <sup>3</sup> .....	0	0	16	27	1	1	6	6
<b>West South Central States:</b>								
Arkansas.....	0	0	13	8	0	1	4	13
Louisiana.....	3	1	14	16	1	1	33	31
Oklahoma <sup>4</sup> .....	0	0	21	13	0	0	18	22
Texas <sup>4</sup> .....	3	7	78	37	0	1	32	35
<b>Mountain States:</b>								
Montana.....	0	12	52	38	10	0	1	3
Idaho.....	0	3	20	2	0	1	1	2
Wyoming.....	0	0	14	1	0	1	0	0
Colorado.....	0	0	107	99	0	0	3	4
New Mexico.....	0	0	6	15	0	0	33	26
Arizona.....	0	0	11	14	0	0	2	2
Utah <sup>4</sup> .....	1	0	52	17	0	0	0	2
<b>Pacific States:</b>								
Washington.....	5	25	41	46	31	17	6	7
Oregon.....	2	2	30	75	0	0	4	2
California.....	21	31	190	196	0	0	14	13
<b>Total.....</b>	<b>223</b>	<b>163</b>	<b>4,001</b>	<b>3,991</b>	<b>80</b>	<b>67</b>	<b>420</b>	<b>523</b>
<b>First 43 weeks of year.....</b>	<b>9,839</b>	<b>6,650</b>	<b>202,863</b>	<b>170,269</b>	<b>5,686</b>	<b>4,140</b>	<b>15,351</b>	<b>18,054</b>

<sup>1</sup> New York City only.

<sup>2</sup> Week ended earlier than Saturday.

<sup>3</sup> Typhus fever, week ended Oct. 26, 1935, 29 cases, as follows: Georgia, 13; Florida, 1; Tennessee, 1; Alabama, 4; Texas, 10.

<sup>4</sup> Exclusive of Oklahoma City and Tulsa.

### Summary of Monthly Reports from States

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

State	Menin- gococ- menin- gitis	Diph- theria	Influ- enza	Mala- ria	Mea- sles	Pel- lagra	Polio- mye- litis	Scarlet fever	Small- pox	Ty- phoid fever
<b>August 1935</b>										
Colorado.....	3	31			23		3	65	1	29
<b>September 1935</b>										
California.....	13	129	61	54	325	7	101	416	4	79
Florida.....		34	4	56	11	2	1	23	0	13
Kansas.....	2	45	3	4	18		7	183	30	35
Louisiana.....	1	91	51	689	24	8	6	28	0	108
Mississippi.....	3	123	995	10,012	26	324	2	77	2	33
Montana.....	1	5	48		14		2	123		12
New Hampshire.....								14	0	4
New York.....	40	98		8	290		1,054	568		147
Oklahoma <sup>1</sup> .....	6	79	102	539	4	10	1	50	1	83
Oregon.....	1		30	13	210		4	97	1	5
Rhode Island.....		4			15		137	33	0	2
Tennessee.....	19	164	111	470	21	31	14	186	1	158
Texas.....	2	265	89	4,026	18	28	6	92	2	208
Virginia.....	9	114	245	79	25	8	64	97	76	6
Washington.....	3	8	15		83	1		109	28	16
Wisconsin.....	4	14	98		173		16	427	6	19

<sup>1</sup> Exclusive of Oklahoma City and Tulsa.

August 1935		September 1935—Continued		September 1935—Continued	
	Cases		Cases		Cases
<b>Colorado:</b>		<b>Hookworm disease:</b>		<b>Septic sore throat—Con.</b>	
Chicken pox.....	19	California.....	1	Tennessee.....	5
Epidemic encephalitis.....	1	Louisiana.....	5	Virginia.....	1
Impetigo contagiosa.....	2	Mississippi.....	301	Washington.....	4
Mumps.....	57	<b>Impetigo contagiosa:</b>		Wisconsin.....	4
Paratyphoid fever.....	2	Kansas.....	5	<b>Tetanus:</b>	
Rocky Mountain spotted fever.....	1	Oklahoma <sup>1</sup> .....	4	California.....	5
Whooping cough.....	51	Oregon.....	35	Kansas.....	4
		Tennessee.....	15	Louisiana.....	4
		Washington.....	6	New York.....	1
		<b>Mumps:</b>		Rhode Island.....	1
		California.....	483	Virginia.....	2
<b>Actinomycosis:</b>		Florida.....	24	<b>Trachoma:</b>	
California.....	2	Kansas.....	128	California.....	10
<b>Anthrax:</b>		Mississippi.....	153	Kansas.....	4
Oklahoma <sup>1</sup> .....	1	Montana.....	62	Mississippi.....	9
<b>Botulism:</b>		Oklahoma <sup>1</sup> .....	6	Montana.....	46
California.....	2	Oregon.....	37	Oklahoma <sup>1</sup> .....	3
<b>Chicken pox:</b>		Rhode Island.....	59	Tennessee.....	26
California.....	280	Tennessee.....	15	Virginia.....	1
Florida.....	4	Texas.....	111	Wisconsin.....	2
Kansas.....	56	Virginia.....	33	<b>Trichinosis:</b>	
Mississippi.....	148	Washington.....	125	California.....	6
Montana.....	59	Wisconsin.....	676	New York.....	11
New York.....	211	<b>Ophthalmia neonatorum:</b>		Oregon.....	1
Oklahoma <sup>1</sup> .....	8	New York.....	3	<b>Tularaemia:</b>	
Oregon.....	27	Oklahoma <sup>1</sup> .....	2	California.....	32
Rhode Island.....	1	Tennessee.....	2	Louisiana.....	1
Tennessee.....	15	Virginia.....	2	Tennessee.....	1
Texas.....	4	<b>Paratyphoid fever:</b>		Texas.....	1
Virginia.....	37	California.....	5	Virginia.....	3
Washington.....	114	Florida.....	3	<b>Typhus fever:</b>	
Wisconsin.....	224	Kansas.....	3	Florida.....	4
<b>Dengue:</b>		New York.....	10	New York.....	3
Florida.....	1	Oregon.....	5	Texas.....	24
Mississippi.....	11	Tennessee.....	7	Virginia.....	1
Texas.....	6	Texas.....	13	<b>Undulant fever:</b>	
<b>Dysentery:</b>		Virginia.....	6	California.....	17
California (amoebic).....	11	<b>Puerperal septicemia:</b>		Florida.....	1
California (bacillary).....	27	Mississippi.....	27	Kansas.....	4
Florida (bacillary).....	4	Tennessee.....	5	Louisiana.....	2
Kansas (bacillary).....	1	Washington.....	1	New York.....	23
Louisiana (amoebic).....	2	<b>Rabies in animals:</b>		Oklahoma <sup>1</sup> .....	1
Mississippi (amoebic).....	88	California.....	49	Rhode Island.....	1
Mississippi (bacillary).....	368	Kansas.....	3	Tennessee.....	3
Montana (bacillary).....	2	Louisiana.....	18	Texas.....	2
New York (amoebic).....	4	Mississippi.....	2	Washington.....	3
New York (bacillary).....	91	New York <sup>1</sup> .....	2	Wisconsin.....	8
Oregon (amoebic).....	3	Oregon.....	1	<b>Vincent's infection:</b>	
Tennessee (bacillary).....	13	Texas.....	20	Kansas.....	3
Texas (amoebic).....	3	Washington.....	1	New York <sup>1</sup> .....	69
Texas (bacillary).....	3	<b>Rabies in man:</b>		Oklahoma <sup>1</sup> .....	1
Virginia (diarrhea included).....	234	Washington.....	1	Oregon.....	5
<b>Epidemic encephalitis:</b>		<b>Relapsing fever:</b>		Tennessee.....	6
California.....	9	California.....	2	<b>Whooping cough:</b>	
Kansas.....	9	<b>Rocky Mountain spotted fever:</b>		California.....	425
New York.....	14	Tennessee.....	1	Florida.....	16
Oklahoma <sup>1</sup> .....	1	Virginia.....	2	Kansas.....	150
Oregon.....	1	<b>Scabies:</b>		Louisiana.....	12
Texas.....	2	Oregon.....	47	Mississippi.....	232
Virginia.....	3	Tennessee.....	10	Montana.....	131
Wisconsin.....	2	<b>Septic sore throat:</b>		New York.....	1,270
<b>Food poisoning:</b>		California.....	6	Oklahoma <sup>1</sup> .....	35
California.....	19	Kansas.....	6	Oregon.....	30
<b>German measles:</b>		Louisiana.....	3	Rhode Island.....	59
California.....	166	Montana.....	24	Tennessee.....	142
Kansas.....	6	New York.....	23	Texas.....	118
Montana.....	4	Oklahoma <sup>1</sup> .....	45	Virginia.....	52
New York.....	72	Rhode Island.....	3	Washington.....	49
Washington.....	33			Wisconsin.....	667
Wisconsin.....	50				

<sup>1</sup> Exclusive of Oklahoma City and Tulsa.<sup>2</sup> Exclusive of New York City.

## WEEKLY REPORTS FROM CITIES

City reports for week ended Oct. 19, 1935

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

State and city	Diph- theria cases	Influenza		Meas- les cases	Pneu- monia deaths	Scar- let fever cases	Small- pox cases	Tuber- culosis deaths	Ty- phoid fever cases	Whoop- ing cough cases	Deaths, all causes
		Cases	Deaths								
<b>Maine:</b>											
Portland.....	0	-----	1	0	1	0	0	0	0	15	30
<b>New Hampshire:</b>											
Concord.....	0	-----	0	0	1	1	0	1	0	0	12
Manchester.....	0	-----	1	0	0	0	0	2	0	0	10
Nashua.....	0	-----		0		2			0	0	
<b>Vermont:</b>											
Barre.....	0	-----	0	0	0	0	0	0	0	0	3
Burlington.....	0	-----	0	0	0	0	0	0	0	0	7
Rutland.....	0	-----	0	0	0	0	0	0	0	2	10
<b>Massachusetts:</b>											
Boston.....	2	-----	0	4	12	27	0	7	3	10	179
Fall River.....	0	-----	0	1	4	4	0	1	0	6	35
Springfield.....	0	-----	0	1	0	4	0	3	0	9	44
Worcester.....	1	-----	0	1	5	15	0	1	0	1	59
<b>Rhode Island:</b>											
Pawtucket.....	0	-----	0	0	0	1	0	0	0	0	13
Providence.....	0	-----	0	0	4	1	0	1	0	13	64
<b>Connecticut:</b>											
Bridgeport.....	1	-----	1	0	2	3	0	1	1	0	38
Hartford.....	0	-----	0	0	2	2	0	1	0	7	36
New Haven.....	1	-----	0	0	0	1	0	0	0	4	35
<b>New York:</b>											
Buffalo.....	0	-----	0	7	20	35	0	3	0	21	150
New York.....	27	-----	10	32	100	76	0	90	17	111	1,428
Rochester.....	1	-----	0	1	2	4	0	0	0	3	59
Syracuse.....	0	-----	0	0	3	4	0	0	0	1	45
<b>New Jersey:</b>											
Camden.....	0	-----	0	0	2	3	0	1	1	1	39
Newark.....	0	-----	3	0	12	15	0	6	1	32	111
Trenton.....	1	-----	0	0	3	4	0	1	0	2	42
<b>Pennsylvania:</b>											
Philadelphia.....	3	-----	0	7	18	57	0	19	5	53	412
Pittsburgh.....	3	-----	0	5	20	54	0	10	1	42	171
Reading.....	2	-----	0	1	2	2	0	0	0	0	23
Scranton.....	0	-----		0		3			0		
<b>Ohio:</b>											
Cincinnati.....	7	-----	0	2	3	13	0	6	0	10	124
Cleveland.....	11	-----	15	1	8	28	0	12	2	44	155
Columbus.....	9	-----	0	0	2	20	0	5	2	2	81
Toledo.....	1	-----	0	0	6	7	0	2	0	3	59
<b>Indiana:</b>											
Anderson.....	0	-----	0	0	0	1	0	2	0	1	12
Fort Wayne.....	11	-----	0	0	5	8	0	0	0	0	21
Indianapolis.....	3	-----	0	3	14	17	0	3	2	9	91
Muncie.....	0	-----	0	3	2	2	0	0	0	0	8
South Bend.....	0	-----	0	0	5	0	0	0	0	0	17
Terre Haute.....	0	-----	0	0	0	1	0	0	0	0	22
<b>Illinois:</b>											
Alton.....	6	-----	0	0	0	2	0	0	0	0	9
Chicago.....	7	-----	5	0	9	32	101	0	35	1	76
Elgin.....	0	-----	0	0	0	7	0	0	0	0	11
Moline.....	1	-----	0	0	1	0	0	0	0	0	5
Springfield.....	1	-----	0	0	2	1	0	0	0	1	24
<b>Michigan:</b>											
Detroit.....	7	-----	3	0	3	17	32	0	16	1	112
Flint.....	1	-----	0	0	4	15	0	1	0	2	36
Grand Rapids.....	0	-----	0	0	1	5	0	0	0	4	32
<b>Wisconsin:</b>											
Kenosha.....	0	-----	0	0	3	14	0	0	0	5	8
Milwaukee.....	0	-----	1	1	7	28	0	5	0	73	90
Racine.....	1	-----	0	1	0	27	0	0	0	12	8
Superior.....	0	-----	0	0	0	1	0	1	0	0	6
<b>Minnesota:</b>											
Duluth.....	0	-----	0	1	1	1	0	0	0	1	16
Minneapolis.....	10	-----	0	5	9	55	0	1	1	8	94
St. Paul.....	0	-----	0	0	7	21	0	1	0	5	61

1 Including delayed reports.

## City reports for week ended Oct. 19, 1935—Continued

State and city	Diph- theria cases	Influenza		Mea- sles cases	Pneu- monia deaths	Scar- let fever cases	Small- pox cases	Tuber- culosis deaths	Ty- phoid fever cases	Whoop- ing cough cases	Deaths, all causes
		Cases	Deaths								
Iowa:											
Cedar Rapids.....	0			0		2	0		0	2	
Davenport.....	0			0		1	0		0	0	
Des Moines.....	0			0		5	0			1	33
Sioux City.....	1			0		3	0		0	2	
Waterloo.....	9			0		7	0		0	0	
Missouri:											
Kansas City.....	1		0	0	7	8	0	4	0	3	84
St. Joseph.....	3		0	0	2	1	0	1	0	0	27
St. Louis.....	21	3	3	2	4	43	0	8	0	2	210
North Dakota:											
Fargo.....	3		0	0	0	3	0	0	0	2	8
Grand Forks.....	0			0		0	0		0	0	
Minot.....	0		0	0	0	1	0	0	0	1	3
South Dakota:											
Aberdeen.....	0			0		0	0		0	0	
Nebraska:											
Omaha.....	13		0	0	2	15	0	1	0	0	54
Kansas:											
Lawrence.....	0		0	0	0	1	0	0	0	0	4
Topeka.....	0		0	0	2	3	0	0	0	1	13
Wichita.....	2		0	1	3	2	0	0	3	1	21
Delaware:											
Wilmington.....	1		0	0	3	0	0	1	1	1	28
Maryland:											
Baltimore.....	5	5	0	0	17	22	0	12	2	14	208
Cumberland.....	2		0	0	1	2	0	0	1	0	19
Frederick.....	0		0	0	0	1	0	0	0	0	1
District of Col.:											
Washington.....	6	1	1	0	7	14	0	9	2	2	190
Virginia:											
Lynchburg.....	1		0	0	0	1	0	0	0	0	9
Norfolk.....	0		0	0	7	1	0	0	0	0	35
Richmond.....	1		0	0	3	1	0	5	1	0	52
Roanoke.....	4		0	0	0	2	0	0	0	0	22
West Virginia:											
Charleston.....	3		0	0	0	8	0	0	0	0	9
Huntington.....	5			0		20	0		0	0	
Wheeling.....	0		0	1	3	7	0	0	1	0	22
North Carolina:											
Gastonia.....	2	2	0	0	1	0	0	0	0	0	5
Raleigh.....	1		0	0	1	0	0	1	0	0	17
Wilmington.....	1		0	0	0	0	0	1	0	0	10
Winston-Salem.....	1		0	0	1	4	0	0	1	0	13
South Carolina:											
Charleston.....	1	14	0	0	1	2	0	2	0	0	23
Columbia.....	0		0	0	0	0	0	0	0	0	4
Florence.....	0		0	0	1	0	0	0	0	0	8
Greenville.....	1		0	0	0	1	0	0	0	0	3
Georgia:											
Atlanta.....	5	4	1	1	5	9	0	6	0	4	78
Brunswick.....	0		0	0	0	0	0	0	0	0	2
Savannah.....	3		0	1	2	4	0	1	0	1	30
Florida:											
Miami.....	4	2	0	1	2	0	0	2	0	1	26
Tampa.....	0		0	0	0	2	0	0	0	0	19
Kentucky:											
Ashland.....	3	0		0		1	0		0	0	
Covington.....	3	0		0	2	7	0	0	0	1	13
Louisville.....	5	6	0	0	2	17	0	2	2	1	55
Tennessee:											
Knoxville.....	6	0		0	3	4	0	0	3	0	22
Memphis.....	1		2	0	5	8	0	6	0	2	83
Nashville.....	4		0	0	3	3	0	2	0	1	50
Alabama:											
Birmingham.....	2	4	0	0	4	3	0	1	0	0	60
Mobile.....	5		0	0	5	0	0	1	1	0	26
Montgomery.....	1			1		1	0		0	0	
Arkansas:											
Fort Smith.....	2			0		3	0		0	0	
Little Rock.....	0		0	1	5	2	0	1	0	0	6
Louisiana:											
Lake Charles.....	0		0	0		0	0		0	0	9
New Orleans.....	10	1	0	0	13	6	0	11	0	20	157
Shreveport.....	2		0	0	2	1	0	2	1	0	35

## City reports for week ended Oct. 19, 1935—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Small-pox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
<b>Texas:</b>											
Dallas.....	10	-----	0	0	3	12	0	3	0	0	58
Fort Worth.....	10	-----	0	-----	1	9	0	1	1	-----	33
Galveston.....	0	-----	0	0	0	0	0	2	2	0	15
Houston.....	13	-----	0	0	2	1	0	6	1	0	76
San Antonio.....	2	-----	2	0	5	0	0	7	0	0	56
<b>Montana:</b>											
Billings.....	0	-----	0	0	0	1	0	0	0	2	2
Great Falls.....	0	-----	0	0	1	2	0	0	0	1	9
Helena.....	0	-----	0	0	0	0	0	0	0	0	5
Missoula.....	0	-----	0	0	1	24	0	0	0	0	5
<b>Idaho:</b>											
Boise.....	0	-----	0	0	2	3	0	0	0	0	7
<b>Colorado:</b>											
Colorado Springs.....	0	-----	1	0	1	6	0	2	0	1	14
Denver.....	2	-----	1	2	4	16	0	4	0	0	75
Pueblo.....	0	-----	0	2	0	13	0	0	0	1	13
<b>New Mexico:</b>											
Albuquerque.....	1	-----	0	0	0	3	0	5	2	0	19
<b>Utah:</b>											
Salt Lake City.....	0	-----	1	0	0	46	0	1	0	7	30
<b>Nevada:</b>											
Reno.....	0	-----	0	0	0	1	0	0	0	0	2
<b>Washington:</b>											
Seattle.....	0	-----	0	1	5	15	0	3	0	0	94
Spokane.....	0	-----	0	2	5	5	3	0	0	0	24
Tacoma.....	-----	-----	-----	4	-----	2	-----	-----	-----	-----	-----
<b>Oregon:</b>											
Portland.....	0	-----	0	3	2	24	0	1	0	0	70
Salem.....	0	-----	-----	0	-----	3	0	-----	0	0	-----
<b>California:</b>											
Los Angeles.....	16	21	0	5	8	22	1	19	6	8	264
Sacramento.....	5	-----	0	1	1	9	0	1	-----	9	22
San Francisco.....	0	2	0	30	7	5	0	6	1	22	179

State and city	Meningococcus meningitis		Polio-myelitis cases	State and city	Meningococcus meningitis		Polio-myelitis cases
	Cases	Deaths			Cases	Deaths	
<b>Maine:</b>				<b>South Dakota:</b>			
Portland.....	0	0	1	Aberdeen.....	0	0	2
<b>Massachusetts:</b>				<b>Maryland:</b>			
Boston.....	1	1	13	Baltimore.....	2	1	2
Springfield.....	0	0	1	<b>District of Columbia:</b>			
Worcester.....	0	0	4	Washington.....	2	3	1
<b>Rhode Island:</b>				<b>Virginia:</b>			
Providence.....	1	0	5	Norfolk.....	12	0	0
<b>Connecticut:</b>				Richmond.....	0	0	3
Hartford.....	0	0	4	<b>North Carolina:</b>			
<b>New York:</b>				Raleigh.....	0	1	0
New York.....	10	3	39	<b>Kentucky:</b>			
<b>New Jersey:</b>				Louisville.....	0	0	6
Newark.....	0	0	2	<b>Tennessee:</b>			
<b>Pennsylvania:</b>				Memphis.....	1	0	0
Philadelphia.....	1	0	5	Nashville.....	0	3	1
Pittsburgh.....	1	0	0	<b>Alabama:</b>			
<b>Ohio:</b>				Birmingham.....	1	0	1
Cincinnati.....	3	1	0	<b>Louisiana:</b>			
Columbus.....	0	1	0	New Orleans.....	0	0	2
<b>Illinois:</b>				Shreveport.....	0	1	0
Chicago.....	2	1	1	<b>Texas:</b>			
<b>Michigan:</b>				Dallas.....	1	1	0
Detroit.....	1	1	1	<b>Utah:</b>			
<b>Wisconsin:</b>				Salt Lake City.....	0	0	1
Kenosha.....	0	0	1	<b>Washington:</b>			
Milwaukee.....	0	0	1	Seattle.....	0	0	2
<b>Minnesota:</b>				<b>California:</b>			
Minneapolis.....	0	1	0	Los Angeles.....	0	0	6
<b>Missouri:</b>				Sacramento.....	1	0	0
St. Louis.....	3	1	1				

1 Imported.

Epidemic encephalitis.—Cases: Boston, 1; Newark, 1; Toledo, 1; Chicago, 1; Superior, 1.

Fellagra.—Cases: Washington, D. C., 1; Birmingham, 1; New Orleans, 1; Dallas, 1; Los Angeles, 3; San Francisco, 1.

Rabies in man.—Deaths: Raleigh, 1; Houston, 1.

Typhus fever.—Cases: Atlanta, 1; Montgomery, 1; New Orleans, 1; Houston, 3.

## FOREIGN AND INSULAR

### CANADA

*Provinces—Communicable diseases—Two weeks ended October 5, 1935.*—During the 2 weeks ended October 5, 1935, certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			1	4	2				1	8
Chicken pox				55	158	58	66	37	45	419
Diphtheria		3	8	25	14	16	5		2	73
Dysentery				13	3					16
Erysipelas				7	5	5		1	4	22
Influenza		15			12	3			38	68
Measles		4	69	117	248	2	30	6	186	662
Mumps		9			125	80	277	12	31	534
Paratyphoid fever	4	4			8				1	17
Pneumonia		3			12		1		6	22
Poliomyelitis					15	4		28	4	56
Scarlet fever	1	20	2	186	184	71	9	13	44	530
Smallpox							3		1	4
Trachoma						1	1		18	20
Tuberculosis	3	66	37	121	140	32	4	5	28	436
Typhoid fever	6	2	19	49	50	3	4	7	4	144
Undulant fever					3					3
Whooping cough		9	17	131	171	65	75	19	17	504

### CZECHOSLOVAKIA

*Communicable diseases—August 1935.*—During the month of August 1935 certain communicable diseases were reported in Czechoslovakia, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	9		Paratyphoid fever	19	1
Cerebrospinal meningitis	7	5	Poliomyelitis	33	2
Chicken pox	22		Puerperal fever	35	12
Diphtheria	1,529	97	Scarlet fever	1,404	20
Dysentery	235	17	Trachoma	114	
Influenza	42	6	Typhoid fever	563	52
Lethargic encephalitis	2	1	Typhus fever	3	
Malaria	538				

## PANAMA CANAL ZONE

*Communicable diseases—July–September 1935.*—During the months of July, August, and September 1935, certain communicable diseases, including imported cases, were reported in the Panama Canal Zone and terminal cities as follows:

Disease	July		August		September	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Chicken pox.....	1				4	
Diphtheria.....	9	1	17	2	14	1
Dysentery (amoebic).....	26	1	35		32	2
Dysentery (bacillary).....	3	1	1			
Leprosy.....	2			1		
Lethargic encephalitis.....			1			
Malaria.....	194	3	84	6	107	1
Measles.....	1				1	
Meningococcus meningitis.....	1		1	1	1	1
Mumps.....	2					
Paratyphoid fever.....			1			
Pneumonia.....		19		17		10
Poliomyelitis.....			1		1	
Tuberculosis.....		27		27		30
Typhoid fever.....	3		4	1	6	
Typhus fever.....	1					
Whooping cough.....	16		5		3	

## VIRGIN ISLANDS

*Notifiable diseases—July–September 1935.*—During the months of July, August, and September 1935, cases of certain notifiable diseases were reported in the Virgin Islands as follows:

Disease	July	August	September	Disease	July	August	September
Chicken pox.....	1	1		Malaria.....	2	3	2
Filariasis.....	6	3	4	Poliomyelitis.....	1	1	
Fish poisoning.....	2			Syphilis.....	21	14	3
Gonorrhea.....	2	9	11	Tuberculosis.....	2	3	
Hookworm disease.....	2	2	2				

## YUGOSLAVIA

*Communicable diseases—September 1935.*—During the month of September 1935 certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax.....	121	6	Poliomyelitis.....	4	
Cerebrospinal meningitis.....	7	3	Scarlet fever.....	449	5
Diphtheria and croup.....	607	61	Sepsis.....	2	1
Dysentery.....	705	79	Tetanus.....	57	18
Erysipelas.....	231	5	Typhoid fever.....	766	69
Measles.....	63	1	Typhus fever.....	11	
Paratyphoid fever.....	47	1			

**CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER**

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for October 25, 1935, pages 1512-1526. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued November 29, 1935, and thereafter, at least for the time being, in the issue published on the last Friday of each month.

**Plague**

*Hawaii Territory—Hawaii Island—Hamakua District—Paauhau Sector.*—A rat which was found October 14, 1935, in Paauhau Sector, Hamakua District, Island of Hawaii, has been proved positive for plague. The rat was found in the course of plague eradication work.

**Yellow Fever**

*Gold Coast.*—Yellow fever has been reported in Gold Coast as follows: On October 6, 1935, 3 cases at Bawku; September 21, 1935, 1 case and 1 death at Tamale.